

What is claimed are:

1. A variable valve control apparatus in an internal combustion engine, that varies an open/close characteristic of an intake valve, comprising:
 - an intake side variable valve mechanism that varies the open/close characteristic of said intake valve;
 - an operating condition detector detecting operating conditions of the internal combustion engine; and
 - a control unit that receives a detection signal from said operating condition detector, and outputs a control signal to said intake side variable valve mechanism based on said detection signal,

wherein said control unit determines a target open/close characteristic of the intake valve and a control speed of when the intake valve is controlled to have said target open/close characteristic, based on the operating conditions of the internal combustion engine, to control said intake side variable valve mechanism.
2. A variable valve control apparatus in an internal combustion engine according to claim 1,

wherein said control unit makes said control speed of the intake valve to be lower in the engine operating condition where a response of engine power torque to a change in the open/close characteristic of the intake valve is quick, compared to the engine operating condition where said response of engine power torque is slow.
3. A variable valve control apparatus in an internal combustion engine according to claim 2,

wherein the engine operating condition where said response of engine power torque is quick is a condition where an engine rotation speed is a predetermined speed or less.
4. A variable valve control apparatus in an internal combustion engine according to claim 1,

wherein said control unit corrects the control signal to be output to said intake side variable valve mechanism, to change said control speed.
5. A variable valve control apparatus in an internal combustion engine according to claim 1,

wherein said control unit corrects the target operating characteristic of said intake valve, to change said control speed.

6. A variable valve control apparatus in an internal combustion engine according to claim 1,

wherein said control unit sets the target operating characteristic of said intake valve based on a target intake air amount.

7. A variable valve control apparatus in an internal combustion engine according to claim 6,

wherein said control unit corrects said target intake air amount to be delayed, to change said control speed based on the corrected target intake air amount.

8. A variable valve control apparatus in an internal combustion engine according to claim 1,

wherein said intake side variable valve mechanism comprises a variable valve event and lift mechanism that varies a valve lift amount and a valve operating angle of said intake valve.

9. A variable valve control apparatus in an internal combustion engine according to claim 8,

wherein said variable valve event and lift mechanism comprises:

a drive shaft rotating in synchronism with a crankshaft;

a drive cam fixed to said drive shaft;

a swing cam swinging to operate said intake valve to open and close;

a transmission mechanism with one end connected to said drive cam side and the other end connected to said swing cam side;

a control shaft having a control cam changing the position of said transmission mechanism; and

an actuator rotating said control shaft, and

successively varies the valve lift amount together with the valve operating angle by rotatably controlling said control shaft by said actuator.

10. A variable valve control apparatus in an internal combustion engine, that varies an open/close characteristic of an intake valve, comprising:

intake side variable valve means for varying the open/close characteristic of said intake valve;

operating condition detecting means for detecting operating conditions of the internal combustion engine; and

intake valve control means for determining a target open/close characteristic of the intake valve and a control speed of when the intake valve is controlled to have said target open/close characteristic, based on the operating conditions of the internal

combustion engine, to control said intake side variable valve means.

11. A variable valve control method in an internal combustion engine, for controlling an intake side variable valve mechanism that varies an open/close characteristic of an intake valve, comprising the steps of:

detecting operating conditions of the internal combustion engine;

determining a target open/close characteristic of said intake valve and a control speed of when the intake valve is controlled to have said target open/close characteristic, based on the operating conditions of the internal combustion engine; and

controlling said intake side variable valve mechanism based on said target open/close characteristic and said control speed.

12. A variable valve control method in an internal combustion engine according to claim 11,

wherein said step of determining a control speed of the intake valve makes said control speed of the intake valve to be lower in the engine operating condition where a response of engine power torque to a change in the open/close characteristic of the intake valve is quick, compared to the engine operating condition where said response of engine power torque is slow.

13. A variable valve control method in an internal combustion engine according to claim 12,

wherein said engine operating condition where said response of engine power torque is quick is a condition where an engine rotation speed is a predetermined speed or less.

14. A variable valve control method in an internal combustion engine according to claim 11,

wherein said step of determining a control speed of the intake valve corrects the control signal to be output to said intake side variable valve mechanism, to change said control speed.

15. A variable valve control method in an internal combustion engine according to claim 11,

wherein said step of determining a control speed of the intake valve corrects the target operating characteristic of the intake valve, to change said control speed.

16. A variable valve control method in an internal combustion engine according to

claim 11,

wherein said step of determining a target operating characteristic of the intake valve sets the target operating characteristic of the intake valve based on a target intake air amount.

17. A variable valve control method in an internal combustion engine according to claim 16,

wherein said step of determining a control speed of the intake valve corrects said target intake air amount to be delayed, to change said control speed based on the corrected target intake air amount.